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J. D. Whitney

Progress of the State Geological  
Survey during the years 1866-7.

Sacramento, 1867.

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LETTER OF THE STATE GEOLOGIST

J. D. Whitney

RELATIVE TO THE PROGRESS OF THE

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STATE GEOLOGICAL SURVEY

DURING THE YEARS 1866-7.



SACRAMENTO:

D. W. GELWICKS, STATE PRINTER.

1867.



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LETTER OF THE STATE GEOLOGIST

RELATIVE TO THE PROGRESS OF THE

STATE GEOLOGICAL SURVEY

DURING THE YEARS 1866-7.

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D. W. GELWICKS.....STATE PRINTER.

## REPORT.

SAN FRANCISCO, November 25th, 1867.

To His Excellency,  
FRED'K F. Low,  
Governor of California:

SIR:—The geological survey of this State has been carried on during the past two years under authority of the Legislature, approved by yourself April fourth, eighteen hundred and sixty-four. Consequently, the office of State Geologist will expire, by constitutional limitation, on the fourth day of April next.

The geological survey has now been going on just seven years, as operations were commenced about December first, eighteen hundred and sixty, the State Geologist having arrived in San Francisco November fourteenth of that year. The amounts which have been appropriated by the different Legislatures for the purpose of the survey are as follows:

At the time of the passage of the original Act.....	\$20,000 00
By the Legislature of 1860-1.....	15,000 00
By the Legislature of 1861-2.....	15,000 00
By the Legislature of 1862-3.....	20,000 00
By the Legislature of 1863-4 (for two years).....	25,600 00
By the Legislature of 1865-6 (for two years).....	30,000 00
Total.....	\$125,600 00

Making an average of fifteen thousand nine hundred dollars a year. In my letter to yourself, dated January first, eighteen hundred and sixty-six, and published by order of the last Legislature, I gave a succinct statement of the condition of the work of the survey at that time, and I will now proceed to recapitulate, as briefly as possible, what progress has been made, both in the fieldwork and in the publication department, since the date of that letter.

I will first, however, allude to our plan of operations, as gradually



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To His Excellency,

FRED'K P. LOW

GOVERNOR

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SIR:—The geological survey of the past two years under your own supervision, and yourself April fourth, 1866, in the office of State Geologist, the fourth day of April, 1866.

The geological survey of the past two years, connect our work of eighteen operations were commenced with that of Mr. Wackenrender, continued in eighteen hundred and sixty-seven. The especial of material for a map, on a large, especially authorized by the last scale of this map will be given in the field until November first, Mr.

At the time of the work, and Mr. Gardner the topographical By the Legislature returned to the Eastern States in November, By the Legislature himself until spring, plotting his summer's By the Legislature have since been employed by the United States By the Legislature special authority of Congress, to make a geological By the Legislature of the region bordering on the Pacific Railroad parallel, in which great work they are still engaged.

Total. Just I left San Francisco, having previously been with mentioned for some time, to make a geographical survey of Plumas County. The party consisted, besides Wackenrender, who had charge of the topographical and during a part of the time by Mr. A. Hartwig, and then W. Keddie, with two men. The geological portion of the work had in charge. This party remained in the field as long as would permit, nearly finishing the work in Plumas, and at doing a part of Sierra, it having been found advisable to do two counties on one map.

are the principal parties in the field during the season.

developed during the progress of our work and finally brought into shape at the time of the publication of the volume devoted to geology. (See Preface, *Geology of California*, Vol. I., where, also, a resumé of the movements of the various parties of the survey, up to the close of the year eighteen hundred and sixty-five, is given.) According to this plan the survey is divided into three principal departments, each of which is again divided into subordinate branches.

The main divisions with the subdivisions may be seen at a glance in the annexed scheme:

A.—*Topography*.—1. Topographical Survey and Maps; 2. Physical Geography.

B.—*Geology*.—1. General Geology; 2. Palæontology; 3. Economical Geology, including Mining and Metallurgy.

C.—*Natural History*.—1. Botany; 2. Zoology.

To the above must be added the collection of a museum of geology and natural history, to illustrate the resources and geological structure of the States and Territories of the Pacific Coast.

Each one of the subdivisions specified above demands one or more volumes of the published series, for the results embraced in it. The number of volumes depends, of course, on the thoroughness with which the work is performed, and that again on the amount of money appropriated.

The following scheme shows the lowest and the highest number of volumes contemplated in each department:

Title of Work.	Highest No. of Volumes .....	
	Lowest No. of Volumes .....	Highest No. of Volumes .....
Physical Geography.....	1	1
General Geology.....	2	2
Economical Geology.....	1	2
Palæontology .....	2	3
Botany .....	1	2
Zoology.....	3	4
Maps.....	1	1
Totals.....	11	15

Of the condition of these volumes, as regards progress in preparation for the press, information will be given further on.

The original Act authorizing the survey, provided for such a complete examination of the State and report on all departments of the geography, geology, and natural history, as is contemplated in the above synopsis of the proposed volumes; and, although the plan may to some have seemed too vast in its scope for the intelligence and the resources of the State, yet it is my firm opinion that if ever carried to completion, its suitableness will be more and more appreciated as the State increases in wealth and civilization. Had the appropriations

asked for by the State Geologist been granted, the work would, without having been any serious burden on the people, be now far advanced towards completion.

With the above brief suggestions, I will proceed to give, first a synopsis of the movements of the different parties which have been in the field during the past two years, and then a concise statement of the present condition of our work, following the order stated above, for the different departments.

#### FIELDWORK OF 1866.

1. Messrs. W. M. Gabb and F. E. Brown commenced January fourth, eighteen hundred and sixty-six, a geological exploration of the southern coast ranges, with the especial purpose of obtaining materials for the palæontology of the tertiary rocks and to determine the geological position and economical value of the bituminous materials found in Los Angeles, Santa Barbara, and San Luis Obispo Counties. This party reached San Luis Obispo, April eighth, and was joined by Mr. Hoffmann, and both geological and topographical work was carried on from there northward, in the Santa Lucia, Gavilan, and Monte Diablo ranges, until June, when the party returned to San Francisco.

2. After writing up his notes, Mr. Gabb continued his work northward of the Bay of San Francisco, assisted by Mr. Frank Coffee, and they proceeded to make a detailed geological examination of a large portion of Sonoma, Mendocino, and Humboldt Counties, returning to San Francisco about the first of November.

3. A party, consisting of Messrs. C. King, J. T. Gardner, H. N. Bolander, and C. R. Brinley, with two men, left San Francisco, June sixth, to commence the geological and topographical survey of the region adjacent to the Yosemite Valley, so as to connect our work of eighteen hundred and sixty-four, in the High Sierra, with that of Mr. Wackenrender, commenced in previous years and continued in eighteen hundred and sixty-six and eighteen hundred and sixty-seven. The especial object of this party was the collection of material for a map, on a large scale, for the Yosemite Guide Book, especially authorized by the last Legislature. (The dimensions and scale of this map will be given further on.) This party remained in the field until November first, Mr. King carrying on the geological work, and Mr. Gardner the topographical. Both these gentlemen returned to the Eastern States in November, where Mr. Gardner occupied himself until spring, plotting his summer's work. These gentlemen have since been employed by the United States War Department, by special authority of Congress, to make a geological and topographical survey of the region bordering on the Pacific Railroad along the fortieth parallel, in which great work they are still engaged.

4. Early in August I left San Francisco, having previously been with the parties above mentioned for some time, to make a geographical and geological survey of Plumas County. The party consisted, besides myself, of Mr. Wackenrender, who had charge of the topographical work, assisted during a part of the time by Mr. A. Hartwig, and then by Mr. A. W. Keddie, with two men. The geological portion of the survey I myself had in charge. This party remained in the field as long as the season would permit, nearly finishing the work in Plumas, and at the same time doing a part of Sierra, it having been found advisable to combine these two counties on one map.

The above were the principal parties in the field during the season of

eighteen hundred and sixty-six; but, in addition, there was considerable field and office work done, chiefly of a topographical character. Mr. Wackenrender was in the field in May and June, mapping the country between the Sonora and the Big Tree roads, across the Sierra Nevada. Mr. George H. Goddard plotted for this survey a large amount of work done in previous years at the head of the Mokelumne, Stanislaus, and American Rivers. He also plotted a considerable area along the eastern boundary of the State, including part of the White Mountain range. Mr. R. D'Heureuse commenced the survey of Kern County, on his own account, which work he was unable to finish, and which was therefore turned over to us on payment of a small portion of its cost, with the understanding that he should go on to complete it during the next year, at the expense of the survey. Mr. S. F. Peckham, in May and June, made a special detailed examination of all the important oil-bearing localities, or those which were reputed as such, for the purpose of securing a supply of material for chemical examination, and to obtain information in regard to the economical value of the bituminous substances of that region.

During the winter of eighteen hundred and sixty-six and sixty-seven, Mr. Gabb was detached from the survey, and accompanied by Mr. F. Von Löhner, made a survey of the Peninsula of Lower California, for private parties. The scientific geological results of this expedition, which were of very considerable value, as giving the first clue to the structure of an extensive and important region, were communicated to and will be published by the California Academy of Sciences.

The chemical examination of the bituminous products collected during the season was carried on at Boston and Providence during the ensuing winter, by Mr. Peckham, for the term of six months, and the results obtained by him will be embodied in the volumes of economical geology.

The fieldwork of this year (eighteen hundred and sixty-six) was prolonged until late in the season, and as early as possible the next year it was resumed, as will be seen from the following synopsis:

#### FIELDWORK OF 1867.

1. Mr. Hoffman, with Mr. A. D. Wilson as assistant, commenced March sixth, to work up the region of the foothills between the Chowchilla and King's Rivers. May twentieth I joined the party, and we continued the surveys to the Big Tree grant and across the Yosemite to Coulterville, where the party was broken up, Mr. Hoffman returning to San Francisco to go on with the office work. Mr. Wilson was then joined by Mr. Von Löhner, and they proceeded to make a survey of the Calaveras Grove of Big Trees on their way to the road across the Sierra, via Placerville.

2. Mr. Gabb, accompanied by Mr. R. E. Poston, about the middle of June, joined Messrs. Wilson and Löhner, and they together proceeded to the eastern border of the State for the purpose of making the necessary surveys to complete the southeastern sheet of the Central California Map. Of this party, a portion of the expenses was paid by the United States and a part by myself. Only that was charged to the State of California which was justly due for work done within its limits. This party, after exploring the White Mountain range, carried their work east as far as the one hundred and sixteenth meridian, working up the geology and topography of an extensive region very difficult to explore, and one in

regard to which there had been up to that time but little definite information obtained.

It was my intention to have the expedition extend its work as far as the eastern border of Nevada, embracing the area between the thirty-seventh and thirty-ninth parallels; but winter set in very early, so that it became necessary to leave the field during the latter part of October.

3. Mr. Hoffman, assisted by Mr. H. Craven as topographer, Mr. W. Harris as photographer, and two men, left San Francisco about the middle of August, and were occupied for about six weeks in completing the work commenced during the previous year by Messrs. King and Gardner, about the head of the Merced and on the upper portion of the Tuolumne.

They explored the interesting valley called by the Indians Hetch-Hetchy, an almost exact counterpart in its general features and in some of its details, of the Yosemite Valley. A number of photographs were taken, of which the negatives are in our possession, to be used in illustrating our future volumes in case it should be desirable. This party also made a minute survey of the bottom of the Yosemite Valley for the Commissioners, to be paid for from the fund to be appropriated for their use. This work was found to be necessary for the purposes of the Commission in carrying out the objects of the grant made by Congress to the State of California.

4. Mr. R. D'Heureuse continued his topographical work in Kern, Tulare, and Inyo Counties, with two assistants, commencing May twenty-eighth, and ending September nineteenth. This survey has been plotted on a scale of two miles to an inch, and embraces an area of about one hundred miles north and south, by fifty in the opposite direction. It takes in all the settled part of Kern County, about half of Tulare, and the western edge of Inyo, embracing the whole of the Sierra Nevada from Walker's Pass to the parallel passing along the lower end of Owen's Lake. Mr. D'Heureuse also collected a large amount of geological information in regard to the region traversed by himself. He discovered an extensive grove of the Big Trees, of the existence of which we have no previous account.

5. Mr. Wackenreder has also been engaged during the whole season, with the exception of two weeks, in continuing his surveys in the central portion of the Sierra Nevada. During this time he has made several trips along the Sierra, between Alpine and Plumas Counties, completing the high part of Alpine, Calaveras, Amador, El Dorado, and Sierra Counties. There is about three months more work to be done to enable us to plot the whole of the Sierra Nevada on the largest scale required, from Walker's Pass to Lassen's Peak, a distance of about four hundred miles in a direct line. The area of the region thus surveyed by our parties during the past four years, including only what may be called the "High Sierra," is about twenty thousand square miles, or fifty miles in width on an average, by four hundred miles long, as stated above. The counties in which the work is deficient are Tuolumne, Nevada, and Placer, but we could plot the whole of the higher portion of these with tolerable accuracy, on the six miles to an inch scale, in case of necessity.

During the past two years the State Geologist has been actively and exclusively engaged in the State attending to the necessary work of the survey in all its departments, with the exception of two short periods of absence, one of four weeks in Oregon and Washington Territory, and one of two weeks in Nevada. These excursions were made for the purpose of settling important geographical and geological questions inti-

mately connected with our own work. Lest, however, misapprehensions should arise, I will state that for absences of this kind there is no charge made to the State, either for salary or expenses incurred.

Having in the preceding pages given a summary of our movements during the past two years, enumerating the times and specifying the localities where the principal parties were at work, I will proceed to state what progress has been made in each department, necessarily with much brevity, following the order of the scheme of our work as given above.

## 1. TOPOGRAPHY AND MAPS.

By far the largest amount of expenditure has been during the past two years in this department of the survey. The reasons for this were twofold: *First*—By the resignation of Professor Brewer, who left our work to take a chair in Yale College, and by the sickness and resignation of Mr. Rémond,\* I had been deprived of my principal geological assistants, and the appropriation was too small to enable me to engage others without dismissing a part of the topographical staff. But the gentlemen employed in this department were engaged on work already commenced, and with which they alone were familiar; hence they could not be dismissed without entirely breaking up the topographical work, and allowing a large amount of valuable material to be utterly lost. *Second*—The want of any even approximately correct maps of any part of the State, made it entirely impossible for us to work out the detailed geology without first preparing such maps as we needed. We could neither lay down the placer mines nor the quartz veins, nor indicate the different strata cropping out on the surface, or make our descriptions of the geological structure of the country intelligible in any other than the most general way, without having an accurate geographical basis for our work. Properly, our work should be carried on *pari passu* in both the geographical and geological departments; but, if means are only provided for one, the former must have the precedence, and be completed first.

The general plan of our topographical work embraces maps on four different scales. The largest is that of a mile to two inches; this is reserved for the most important mining districts, where the special illustration of the occurrence of veins or mineral deposits makes a large scale necessary. The next is two miles to an inch; this is the scale of the Bay Map and of the County Maps in progress, as will be noticed further on. The next is six miles to an inch; this scale is adopted for the Central California Map; and finally, a scale of ten or twelve miles to an inch will have to be adopted for a general map of the State, if we ever are able to compile one from our materials. I did, in former years,

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\*Mr. Rémond left the survey early in eighteen hundred and sixty-six, being completely broken down in health—constitutional tendencies to disease of the lungs having been aggravated and hastened towards a fatal termination by his arduous exertions and devotion to the work in which he was engaged. He removed to Santiago, Chile, in the hope that the climate of that country might exercise a beneficial influence on his health. It was too late, however; the hand of death was on him, and he returned to California, after a little more than a year's absence, living only a few days after landing in San Francisco. He died at the early age of twenty-nine, May thirty-first, eighteen hundred and sixty-seven. He was an enthusiastic lover of the natural sciences, with remarkable perceptive powers, and full of energy and perseverance. Had his life been spared, he would have risen to an eminent position in his favorite departments of geology and palæontology. His valuable work in connection with our survey, and especially that carried on by him under the greatest difficulties in Northern Mexico, will entitle him to be ranked among those who have done much to aid the cause of science on the Pacific coast.

contemplate as large a scale as six miles to an inch for the general map of the State; but this would require nine sheets, and seems too extensive an undertaking for our means, or for any means that we are ever likely to be supplied with; and the publication on that scale of the Central California Map, which embraces only one third of the area of the State, but ninety-five per cent. of its population, will render it less necessary to use so large a scale for the very thinly inhabited region of the extreme north and south.

To pass to the statement of what is accomplished in collecting the materials and putting them on paper, in accordance with the above plan, the following is submitted:

(a) *Scale of a mile to two inches.*—On this scale a map of the vicinity of Monte Diablo has been completed, and is now ready for the engraver. It is two and a half by three feet in size, and embraces the most important coal deposits yet discovered in the State. It covers an area of one hundred and seventy square miles. The Map of the Yosemite Valley, made by Mr. Gardner, and engraved for the Yosemite Book, is also on this scale. It is fifteen inches by twenty-four in size.

(b) *Scale of two miles to one inch.*—On this scale the "Map of the vicinity of the Bay of San Francisco" has been drawn and engraved. This map covers an area of four thousand two hundred and forty-eight square miles of land, just about equal to that of the State of Connecticut. It is four feet by three in size, and has been engraved on two sheets. It embraces the whole of San Francisco, San Mateo, Contra Costa, Alameda, and Marin Counties, a large portion of Santa Cruz and Santa Clara, and a part of Solano, Sonoma, and Napa. This is the most densely settled portion of the State, containing as it does the heart of the agricultural and commercial region. Over one third of the population of California reside within its borders. This map has been engraved in New York, and copies of it are expected by the next steamer. Much delay in issuing it has been caused by the necessity of sending proof sheets back and forth from San Francisco to New York, and also by the numerous changes which have been made in the boundaries of ranches during the past two years.

On the same scale as the Bay Map, three maps of the central counties of the State along the Sierra Nevada, and including the principal mining region of the State, are projected. Of these, the northern one embraces Plumas and Sierra, and parts of Yuba and Butte Counties; the central, Nevada, Placer, El Dorado, Amador, and Calaveras, and portions of Yuba, Butte, Sutter, Sacramento, and San Joaquin; the southern, part of Calaveras, all of Tuolumne and Mariposa, and parts of Stanislaus, Merced, and Fresno Counties. Of these, the fieldwork for Plumas and Sierra is nearly completed, and the map can be drawn whenever the state of our funds permits it. The Central County Map is commenced, and the fieldwork about one third completed; that of the southern counties is also about one third completed. These maps are intended to show the minute details of the topography; the position of all towns, villages, mining camps, and ranches; the roads, mines, mills, and ditches; and, in short, to answer all the requirements of the different counties for geographical purposes.

On the same scale as the Bay Map is also drawn the "Map of a portion of the Sierra Nevada adjacent to the Yosemite." This is thirty inches by twenty in size, embracing between two and three thousand



square miles of one of the roughest and most picturesque regions of the State. It extends from Mariposa and Big Oak Flat on the west, to the head of the San Joaquin and Mono Lake on the east. It is the first accurate map of any high mountain region ever prepared in the United States. This map is now drawn, and in the hands of the engravers. It is intended to accompany the Yosemite Book.

A large amount of material in Kern, Tulare, Inyo, Alpine, and Mono Counties has been plotted on this scale, not necessarily for publication, but for use in compiling the general map of the State.

(c) *Scale of six miles to one inch.*—This is the scale adopted for the Central California Map, which embraces the region from Owen's Lake north to Lassen's Peak, and from Clear Lake east to the meridian, which passes a little east of Owen's Lake and a few miles west of Austin, Nevada. It is embraced between the parallels of  $36^{\circ}$  and  $40^{\circ} 30'$  and the meridians of  $117^{\circ} 30'$  and  $123^{\circ}$ . It is in four sheets, each twenty-four inches square, and covers an area of about eighty thousand square miles, of which, however, owing to the peculiar shape of the eastern boundary of California, a portion is within the State of Nevada—about eighteen thousand square miles. About one third of the area of California is embraced in this map, and as before remarked, fully ninety-five per cent. of its population, according to the last census. The four sheets are intended to be put together for use as a wall map, which will be about four feet square. Of this Central California Map, the southwest quarter, embracing the region of the coast range from about twenty miles south of Monterey to Santa Rosa, and a portion of the Sierra Nevada in Calaveras and Amador Counties, is drawn and ready for the engraver. The southeast quarter is also partly drawn, and the field work is entirely completed, with the exception of a small section east of Owen's Lake, which is not accessible without an escort. This sheet, however, will be completed so as to be ready for the engraver in the spring, making half the map done. Of the remaining half, the eastern quarter is nearly finished as to fieldwork, say four fifths completed, while the western quarter is about half done. With two parties in the field next season, this map can be completed and drawn, ready for publication, in about two years. This, the largest inland work of topography yet undertaken in the United States, as it aims to give the topography as accurately and as much in detail as it can be shown on the scale adopted, of eighty thousand square miles of country, a large part of which is very mountainous, including the highest and roughest elevations in the country, and probably on the North American Continent. The Nevada portion of the map will be filled in from various sources, among which may be particularly mentioned the Central Pacific Railroad surveys, and the work carried on in eighteen hundred and sixty-seven by the United States, both under the authority of the War and of the Interior Departments. Enough has been done this year in Nevada to give a very good idea of the topography of the western and central portion of the State, and to make the worthlessness of the maps compiled from the previously obtained data appear perfectly evident. To form an idea of the size of California and the magnitude of our work, it should be remembered that the area embraced on our Central Map is twice that of Ohio, one of the largest States east of the Mississippi.

On the same scale of six miles to an inch, we commenced at an early period in the survey a map of the coast ranges south of the Bay of Monterey, and extending to Santa Barbara. It is three feet by two and a half in dimensions, and embraces about sixteen thousand square miles

of territory, in Monterey, Santa Barbara, and San Luis Obispo Counties. The information obtained from time to time during the progress of the survey has been added to it, and it is now completed as far as the fifth standard line south of the base line. A party would be able to finish the fieldwork remaining to be done on this map in two seasons, or six months of fieldwork.

(d) *Scale of ten miles to one inch.*—This will probably be the scale adopted for the final general map of the whole State, and this map would be about five feet square, in four sheets, and would also necessarily embrace a large portion of Nevada, unless the space were designedly left blank. For this map we have already a large amount of material, comprised in not less than one hundred sheets, portions of which have, of course, been used in the other maps now in progress. All these sheets should be looked on as so much plane table work, to be compiled hereafter and co-ordinated by a system of carefully conducted astronomical observations, which will fix the position of a considerable number of points on the different sheets with great accuracy. Until this is done we can never have even a tolerable map of the whole State, as there are errors and discrepancies in the work of the United States Land Office which can only be cleared up by a careful series of astronomical observations. The portions of the State where most remains to be done in the topography are the southeastern and northwestern corners, regions the most thinly inhabited of any, and where Indians have frequently been very troublesome.

## 2. PHYSICAL GEOGRAPHY.

The collection of materials in this department has gone on uninterruptedly. The number of barometrical observations for the determination of absolute heights of important points, has greatly increased during the past two years. The important investigations of Colonel R. S. Williamson in regard to the fluctuations of the barometer on this coast, are now in process of publication; and when this volume shall have been completed, it will be advisable for us to commence a systematic revision of all our barometrical works, and to publish the final connected results in a tabular form. We shall be able to give a close approximation to the heights of between one and two thousand points in this State, including all the higher mountains and most of the towns and mining camps. To compute the observations already made will, however, require not less than a year's unremitting labor; but the results will be of great practical as well as scientific value.

We have continued the investigation of other subjects connected with the physical geography of the State. Among them, the nature and distribution of the forest trees may be mentioned, as of peculiar interest.

A beginning has been made in the construction of a map on which the boundaries of the areas occupied by the principal groups of trees are laid down.

## 3. GENERAL GEOLOGY.

For the reasons stated above, much less progress has been made in the strictly geological than in the topographical department. Still, a very considerable amount of work has been done, as will be seen from the above synopsis of the operations and movements of the various parties during the past two years. This synopsis will also show where, when and by what persons the geological work has been executed.

A large amount of material has been accumulated for the remaining volume of geology which it is proposed to issue; but this volume will be the last one published of the series, as it will be intended as a complete resumé of all the geological and palæontological work. It will be accompanied by all the necessary sections, showing the structure of the mountain ranges, and with a geological map of California, and probably of all the Pacific States and Territories.

#### 4. PALÆONTOLOGY.

But little exclusively palæontological work has been done within the past two years, as Mr. Gabb has been employed in the field during most of the time when in the service of the survey, as will be seen from the synopsis of the movements of our parties given above. Most of the work performed has been in the way of arranging the collection of fossils, unpacking the materials obtained, and selecting such as was wanted for description. (See further on, under the head of "Publications.")

#### 5. ECONOMICAL GEOLOGY.

It is proposed in this department to prepare first that portion of the report which includes the non-metalliferous minerals. Under this head will be included coal, all bituminous substances, asphaltum, maltha, petroleum, building materials, cements, paints, ochres, and earthy materials in general.

No plans can be made with regard to the continuation of the economical geology so as to embrace the full and complete investigation of the mines of the State, unless the Legislature can be induced to make a more liberal provision for the support of the survey. It is useless to commence in this department unless the work in it can be thoroughly done. We have enough already of crude estimates, superficial investigations, and other worthless rubbish. If properly executed, the work in this department will be of the greatest pecuniary value to the State; but the Legislature cannot expect results of this high importance without any outlay. Eminent mining engineers and chemists cannot be found willing to work with salaries less than the wages of ordinary mechanics.

#### 6. BOTANY.

The collection of material for the botanical report has been continued during the past two years in such a manner as to be but a trifling expense to the State. Mr. Bolander has had charge of this department, and has made extensive additions to our collections and to the material placed in the hands of the botanical collaborators of the survey in the Eastern States and in Europe. Indeed, so many new discoveries have been made, that the thorough working up of our materials seems likely to occupy a somewhat longer time than was expected.

Mr. Bolander was in the field from April eleventh, eighteen hundred and sixty-six, to September twenty-fifth, collecting in Mariposa, Tuolumne, and Mono Counties. In eighteen hundred and sixty-seven he made another excursion of a month through Sonoma, Mendocino, and Humboldt Counties; and later in the season, spent some time in Santa Cruz and San Mateo. The northern part of the State, namely, Trinity, Humboldt, Klamath, and Del Norte, is the portion which now most needs botanical exploration. Another month's collecting in San Diego

is also highly desirable. Professor Brewer thinks that the volume under his charge will be ready for the press during the next year.

#### 7. ZOOLOGY.

All that has been done in this department will be found further on, under the heads of "Publications" and "Museum."

#### 8. MUSEUM.

The same statement has this year to be repeated which has already been made so many times before. The collections of the survey are large and valuable, but are exposed to loss by fire, and are placed where there is no possibility of displaying them in a proper manner, or having them open to the general public so as to form an attractive and instructive exhibition.

But considerable has been done within the past two years towards getting our multifarious materials in order. A part of the minerals, ores, and rock specimens, are laid out on shelves, so as to be examined without difficulty. The fossils are arranged in handsome cases, and named, so far as practicable, so that they can be consulted by students in that department. The shells of the species now living on this coast have also been very carefully arranged, named, and labelled, and can be studied at all times by those interested in this branch of natural history. The plants have been placed in cases, arranged in families and genera, so far as known, and the specific names are added as fast as they are received from the various authorities engaged in working them up. The cones of all the pines, firs, and spruces, the seeds, fruits, etc., have been arranged in drawers, as well as the cryptogamic vegetation so far as it has yet been worked out.

#### 9. PUBLICATIONS.

Since the last session of the Legislature, the following publications have been issued by the Survey:

*Palæontology*, Vol. II, Section 1, Part 1, comprising the first instalment of the Tertiary Invertebrate Fossils; by Mr. Gabb. This is accompanied by thirteen plates, which have been lithographed, and which will soon be ready for delivery. The text is stereotyped. It is estimated that the whole of this volume will be required for the remainder of the Cretaceous and Tertiary invertebrate fossils. A third volume will contain the other Secondary and the Palæozoic fossils, the plants, vertebrate remains, and the microscopic fossils, the material for these researches being already in the hands of eminent authorities at the East.

*Geographical Catalogue of the Mollusca found west of the Rocky Mountains*; by Dr. Cooper. This was prepared to facilitate the arrangement of the conchological collection and for convenience in exchanging. It contains the names and localities of eight hundred and twenty-five species, so printed that the catalogue may serve for labels as well as for a check-list.

*Mining Statistics*, No. 1, containing the quartz mines and mills between the Merced and Stanislaus Rivers; by A. Rémond.

In the zoological series the drawing and engraving for the volumes of birds and fishes has been going on steadily, and that of the birds is believed to be so nearly completed that the work can go to press imme-

diately. Arrangements have also been made for editing and issuing the volume of conchology, and a beginning made on the mammals.

The Bay Map in two sheets, as mentioned above, has been in the engraver's hands for more than a year, and is supposed to be on its way out to California. It is intended to be sold separately, in various styles, and also to form one of the series in the volume of maps, sections, and illustrations.

Both maps for the Yosemite Book are drawn, and one is engraved. The illustrations are also prepared, and the work can go to press at an early day.

The finished sheet of the Central California Map will soon be sent to the engraver.

The preparation of the first volume of the Economical Geology will be commenced as soon as favorable action has been had by the Legislature on the question of the continuance of the survey.

The plan of the "Yosemite Book," in its two editions of the "Guide Book" and "Gift Book," will be found stated at length in the report of the Yosemite Commissioners. It is intended that the "Gift Book" shall be as elegant a volume as has ever been published in this country.

#### 10. ACCOUNTS AND EXPENDITURES.

The accounts of the survey, and a complete statement of all expenditures in the different departments, will be submitted at an early date to the committee of the Legislature to which the subject of the geological survey may be referred.

It may be stated, however, that our expenditures have overrun the appropriation made for the survey. At the end of the current year I shall have expended about eight thousand five hundred dollars more than the total appropriation, as will be seen from the following concise statement:

##### STATEMENT OF EXPENDITURES OF GEOLOGICAL SURVEY.

To December 31, 1865,* as per account previously rendered.	\$89,998 71
January 1 to December 31, 1866.....	22,617 66
January 1 to September 30, 1867.....	15,853 40
Estimate October 1 to December 31, 1867.....	5,600 00
	<hr/>
Total appropriations.....	\$134,069 77
	125,600 00
	<hr/>
Deficiency at end of 1867 .....	\$8,469 77

Allowing that all the fieldwork is discontinued, and nothing done for the next six months except to plot and write up the work already on hand, it will require at least six thousand five hundred dollars to continue the survey to the end of the current fiscal year, and I have to ask,

\*See Report of the Committee on Mines and Mining in the Assembly to the last Legislature, in which our expenditures are tabulated in full to December thirty-first, eighteen hundred and sixty-five.

therefore, that an appropriation for the continuance of the survey during the present fiscal year, of at least fifteen thousand dollars, be inserted in the deficiency bill, or else acted on separately near the beginning of the session. Should this not be passed, it will be my duty to dismiss all my assistants and to discontinue the survey at once, a step which I should greatly regret having to take, as there is much valuable matter in my hands either in process of publication or nearly ready to go to the printer and engraver.

I might have discontinued the survey at the time the appropriation was exhausted; but I preferred to take the risk of overrunning the appropriation rather than abandon the work, although it has not been without difficulty that I have continued it, and not without considerable pecuniary embarrassment.

I have the honor to be, with high respect,

Your obedient servant,

J. D. WHITNEY,  
State Geologist.









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